DOCUMENT RESUME

ED 358 343 CE 063 923

| | |
|---|---|
| TITLE | Computer Engineering Technology. Florida Vocational Program Guide. |
| INSTITUTION | University of South Florida, Tampa. Dept. of Adult and Vocational Education. |
| SPONS AGENCY | Florida State Dept. of Education, Tallahassee. Div. of Vocational, Adult, and Community Education. |
| PUB DATE | Jun 91 |
| NOTE | 65p. |
| AVAILABLE FROM | Division of Vocational, Adult, and Community Education, Bureau of Career Development and Educational Improvement, Florida Education Center, Tallahassee, FL 32399-0400 (order no. IE588 BK 91, guide; IE587 BK 91, Career Merit Achievement Plan). |
| PUB TYPE | Guides - Classroom Use - Teaching Guides (For Teacher) (052) |
| EDRS PRICE | MF01 Plus Postage. PC Not Available from EDRS. |
| DESCRIPTORS | Articulation (Education); Behavioral Objectives; *Career Development; Classroom Techniques; Competence; Competency Based Education; *Computers; Educational Resources; *Engineering; Entry Workers; Job Skills; Paraprofessional Personnel; Postsecondary Education; Program Guides; *Program Implementation; Secondary Education; State Standards; *Student Evaluation; Teaching Methods; Test Items |
| IDENTIFIERS | Florida |

ABSTRACT

This packet contains a program guide and Career Merit Achievement Plan (Career MAP) for the implementation of a computer engineering technology program in Florida secondary and postsecondary schools. The program guide describes the program content and structure, provides a program description, lists job titles under the program, and includes a curriculum framework and student performance standards for computer engineering technology courses. The curriculum framework outlines major concepts and content, laboratory activities, program specifics, and intended outcomes; the student performance standards guide lists each standard and the behaviors expected to show mastery of each standard. The guide also provides information on the following: (1) program implementation; (2) instructional resources (a listing of 34 print materials, 3 audiovisuals, and 3 software programs, along with publishers' addresses); (3) facility design for computer engineering technology laboratories and classrooms, equipment, safety, maintenance, and liability; and (4) teacher professional development, teacher certification, professional organizations and support services. The Career MAP is a checklist, to be kept by student and teacher, of student progress in the competencies required for entry into jobs in the computer engineering technology field. (KC)

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

# FLORIDA VOCATIONAL PROGRAM GUIDE FOR

# COMPUTER ENGINEERING TECHNOLOGY

Prepared by

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Division of Vocational, Adult, and Community Education
Bureau of Vocational Program and Staff Development

June, 1991

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# ACKNOWLEDGEMENTS

The Division of Vocational, Adult, and Community Education expresses appreciation to the staff of the Career MAPs project at the University of South Florida under the direction of Jack Grisham for their efforts in preparing this program guide. Staff members are Karen Childress, Marjorie Stevens, Joan Evans, Sandra Stokes and Dana Gruman.

The Division would also like to thank the following industry representatives and vocational educators who, by sharing ideas at conferences and workshops, have contributed to the content of this publication.

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Charles Wilhite, Tandy Computer
Joe Smariga, Computers for Business, Int.
Ben Douglas, Lockheed Space Operations Co.
Michael K. Bearden, Tampa Electric Company
Ronnie J. Barber, Manatee River Labs
Randy Dautrich, Aidlin Automation Corp.
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# INTRODUCTION

Vocational education meets the needs of students desiring to pursue a selected vocation and is designed to provide training that is realistic in meeting present and future employment opportunities. In recent years, applications of science and technology have expanded rapidly, increasing the education and training required of workers. This has made vocational training programs more attractive as an educational option. The new technologies require well-trained workers to carry out both standardized and specialized procedures, and whose training foundations have given them the capacity to keep pace with continuing technology demands.

The Florida Department of Education shares with business and industry the determination to provide opportunities for upward mobility to as many Floridians as possible. Vocational training programs can keep pace with the demands of new industrial patterns and can provide the opportunity for many of our citizens to gain financial stability and an improved sense of self worth. Therefore, it is necessary to create exemplary vocational programs and to make those programs consistent throughout the state.

This Program Guide identifies primary concerns that should be considered in the organization, operation and evaluation of a vocational education program. It has been developed to provide useful information to local school district and community college administrators, instructors, program advisory committees, regional coordinating councils and others charged with the responsibility of offering vocational education programs.

# OCCUPATIONAL DESCRIPTION

One who has completed the Computer Engineering Technology program may be employed to perform repairs on electronic equipment, such as computers, industrial controls, radar systems, telemetering and missile control systems, transmitters, antennas and servomechanisms. The job tasks may include

- Following blueprints and manufacturers' specifications and using handtools and test instruments
- Testing faulty equipment and applying knowledge of functional operation of electronic units and systems to diagnose cause of malfunction
- Testing electronic components and circuits to locate defects, using oscilloscopes, signal generators, ammeters and voltmeters.
- Replacing defective components and wiring and adjusting mechanical parts, using handtools and soldering iron
- Aligning, adjusting and calibrating equipment according to specifications and calibrating testing instruments
- Maintaining records of repairs, calibrations and tests

# PROGRAM CONTENT

The Division of Vocational, Adult, and Community Education, as required by State Board of Education (**S.B.E.**) **Rule 6A-6.0571**, publishes Vocational Education Program Courses Standards annually. This document specifies the minimum program content for the operation of a vocational training program for the occupational titles listed. Each program identified in the Florida Department of Education Course Code Directory is required to establish course standards. The standards for each vocational offering are comprised of two major components: (1) Curriculum Framework and (2) Student Performance Standards.

## Curriculum Framework (CF)

The Curriculum Framework specifies the exact course title, course number, levels of instruction, major course content, laboratory activities, special notes, major course concepts and intended outcomes. The program requirements stipulated in the curriculum framework have been approved by the State Board of Education and are the legal bases for delivery of instruction.

## Student Performance Standards (SPS)

The Student Performance Standards are a resource list of job-specific competencies. This list is generated and approved by industry experts and becomes the basis for curriculum development in vocational programs. Local school districts and community colleges must, by law, adopt student performance standards for their vocational programs. They may, at their discretion, adopt the list provided or develop their own as long as there is sufficient content to address each intended outcome. A program may provide instruction beyond the minimum specified in the SPS if desired. The decision to do this should be based on local industry needs. However, the minimum must be presented.

The SPS for secondary level programs contain a third component, course structure. This component specifies the number of courses required for program completion and the content of each course. The courses may be taught in any sequence, but the content may not be changed unless approved by the Division of Vocational, Adult, and Community Education.

The curriculum framework and student performance standards are intended for use as a guide, not a teaching tool. Teachers or curriculum development personnel are expected to develop or select complete curriculum materials for their training programs based on the curriculum framework and student performance standards. Each intended outcome and SPS should be thoroughly analyzed for related cognitive and procedural subskills. The curriculum framework and student performance standards are presented in the following pages.

CURRICULUM FRAMEWORK PROGRAM AREA: Industrial

FLORIDA DEPARTMENT OF EDUCATION EFFECTIVE DATE: July, 1991

PROGRAM TITLE: Computer Engineering Technology

CODE NUMBER: Secondary _____ Postsecondary _____

Florida CIP 0615.040200

SECONDARY SCHOOL CREDITS __ COLLEGE CREDITS X POSTSECONDARY ADULT VOCATIONAL CREDITS ___

APPLICABLE LEVELS(S): __ 7-9 __ 9-12 __ Postsecondary Adult Vocational

X Postsecondary Vocational ____ Other

CERTIFICATION COVERAGE: COMP SVC 7

I. MAJOR CONCEPTS/CONTENT: This program is designed to prepare students for employment as computer engineering technicians or in related occupations in electronics or to provide supplemental training for persons currently or previously employed in these occupations.

Electronic Technology and/or Electronic Engineering Technology (CORE) are prerequisites for entry into this electronic specialization program. The CORE program prepares individuals to assemble, install, operate, maintain, troubleshoot and repair electronic equipment used in industry. In addition, it also includes content related to the design, theory, and analysis of electronic systems and applications.

This specialization content includes, but is not limited to, computer systems architecture, software, communications, programming and analysis and design of computer systems.

II. LABORATORY ACTIVITIES: Electronic laboratory activities are an integral part of this program. The tools, test equipment, materials and processes used in this laboratory are similar to those used in industry. Students should be able to use the various types of precision test equipment found in general use throughout the electronics industry for the purpose of analyzing, troubleshooting and repairing computer circuitry.

III. SPECIAL NOTE: As part of an Associate in Science Degree, there is a major component of general education requirements which allows the student to more easily relate the technical knowledge gained to a theoretical level and to allow for greater knowledge expansion and transference in the future.

This general education requirement must have a minimum of 15 semester hours with at least one course in oral and written communication and one course in computational skills. The computational skills should include algebra and trigonometry.

The cooperative method of instruction may be utilized for this program. When the cooperative method is offered, the following is required for each student: a training plan signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; and a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

To be transferable statewide between institutions, this program/course must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

The typical length of this program for the average achieving student is is an Associate in Science Degree.

IV. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

01. Demonstrate proficiency in computer systems architecture.
02. Demonstrate proficiency in software fundamentals.
03. Demonstrate proficiency in communication interfacing.
04. Demonstrate proficiency in peripheral equipment.
05. Demonstrate proficiency in customer site requirements and considerations.
06. Demonstrate proficiency in customer relations.
07. Demonstrate proficiency with high-level computer programming languages.
08. Demonstrate proficiency in computer networking techniques.
09. Demonstrate proficiency in the use of microcomputer disk operating system services and functions.
10. Demonstrate proficiency in analysis and design of data communications systems.
11. Demonstrate proficiency in the analysis and design of peripheral equipment used in computer systems.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: July, 1991

PROGRAM AREA: Industrial SECONDARY NUMBER:

PROGRAM TITLE: Computer Engineering Technology POSTSECONDARY NUMBER:

01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE--The student will be able to:

- 01.01 Draw and explain systems configurations in block detail.
- 01.02 Interpret computer acronyms.
- 01.03 Identify and define priorities and interrupts at system level.
- 01.04 Define and list direct memory access handling systems.
- 01.05 Define functions of advanced memory techniques (e.g. virtual, pipeline, cache).
- 01.06 Troubleshoot a microcomputer system.

02.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS--The student will be able to:

- 02.01 Load and run operating system software.
- 02.02 Load and run diagnostic software and utilities.
- 02.03 Construct flow charts.
- 02.04 Analyze flow charts.
- 02.05 Identify and define computer languages and their uses.
- 02.06 Write a simple computer program in BASIC.
- 02.07 Read a PROM.
- 02.08 Erase and program an EPROM.
- 02.09 Analyze firmware concepts.
- 02.10 Troubleshoot firmware using defined hardware.
- 02.11 Analyze firmware writing concepts.

03.0 DEMONSTRATE PROFICIENCY IN COMMUNICATION INTERFACING--The student will be able to:

- 03.01 Identify and define serial and parallel interface standards.
- 03.02 Identify, define and configure sync and async devices.
- 03.03 Demonstrate the use of interface devices.
- 03.04 Identify and define networking levels.
- 03.05 Identify and define protocols.
- 03.06 Troubleshoot and repair network systems.
- 03.07 Identify and define multiuser systems.

04.0 DEMONSTRATE PROFICIENCY IN PERIPHERAL EQUIPMENT--The student will be able to:

- 04.01 Install, analyze and troubleshoot interface controllers.
- 04.02 Install, analyze and troubleshoot display terminals.
- 04.03 Install, analyze and troubleshoot printer.
- 04.04 Install, analyze and troubleshoot magnetic tape equipment.
- 04.05 Install, analyze and troubleshoot disk drive equipment.
- 04.06 Define environmental requirements for peripherals and media.

05.0 DEMONSTRATE PROFICIENCY IN CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS--The student will be able to:

- 05.01 Apply effective customer relations.
- 05.01 Follow installation procedures.
- 05.02 Calculate and determine power requirements.
- 05.03 Calculate and determine environmental requirements.
- 05.04 List and perform preventative maintenance techniques and requirements.

06.0 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS--The student will be able to:

- 06.01 Describe effective listening techniques.
- 06.02 Describe techniques for instilling customer confidence.
- 06.03 Describe techniques for keeping the customer informed.
- 06.04 Demonstrate proper follow-up techniques.

07.0 DEMONSTRATE PROFICIENCY WITH HIGH-LEVEL COMPUTER PROGRAMMING LANGUAGES--The student will be able to:

- 07.01 Write a technical program in a high-level programming language (e.g. Fortran, Cobol, Basic, C) and associated system level concepts.
- 07.02 Identify and define associated system level concepts.
- 07.03 Apply structured programming such as loop structures, sorting techniques, data structures and arithmetic operations.

08.0 DEMONSTRATE PROFICIENCY IN COMPUTER NETWORKING TECHNIQUES --The student will be able to:

- 08.01 Identify and define computer networking techniques.
- 08.02 Design a system using hardware and software communication protocols.
- 08.03 Apply management techniques for network software.

09.0 DEMONSTRATE PROFICIENCY IN THE USE OF MICROCOMPUTER DISK OPERATING SYSTEM SERVICES AND FUNCTIONS--The student will be able to:

- 09.01 Describe the historical development of computer operating systems.
- 09.02 Describe the major hardware and related software subsystems of microcomputer DOS (Disk Operating System).
- 09.03 Describe various disk formats.
- 09.04 Program using assembly language to access the ROM-BIOS (Read-Only Memory-Basic Input/Output System) feature for peripheral control and serial communications.
- 09.05 Describe the extended services of enhanced systems.
- 09.06 Describe design decisions involved in implementing Input/Output (I/O) interfacing using interrupts.
- 09.07 Program using assembly language to implement I/O device interfacing using interrupts.
- 09.08 Program using the extended DOS functions.

09.09 Analyze and design software systems using ROM-BIOS, DOS functions and interrupts for use in a multiplexed analog to digital system.
09.10 Analyze and design software systems using ROM-BIOS functions and interrupts for use in a synchronous digital data system.

10.0 DEMONSTRATE PROFICIENCY IN ANALYSIS AND DESIGN OF DATA COMMUNICATIONS SYSTEMS--The student will be able to:

10.01 Describe the different types of digital data communications systems.
10.02 Describe data formats and transmission rates in serial data communications systems.
10.03 Design the connections and programming for a UART (Universal Asynchronous/Synchronous Receiver Transmitter) in a microprocessor-based system.
10.04 Identify and define available options for integration of a display terminal in a data communication system.
10.05 Identify and define communication signals and protocol for MODEM (Modulator Demodulator) links.
10.06 Apply digital modulation techniques including PAM (Pulse-Amplitude Modulation), PCM (Pulse-Code Modulation), PWM (Pulse-Width Modulation) and delta modulation.
10.07 Analyze and design circuits for generation and detection of digital modulation.
10.08 Apply error detection and correction in digital communication systems.
10.09 Define communication protocols.
10.10 Design and apply multiplexing techniques for computer.

11.0 DEMONSTRATE PROFICIENCY IN THE ANALYSIS AND DESIGN OF PERIPHERAL EQUIPMENT USED IN COMPUTER SYSTEMS--The student will be able to:

11.01 Design and analyze circuits used in various functions of video display systems.
11.02 Analyze various types of disk drives and disk drive controllers.
11.03 Analyze various types of printers and plotters and their related interface controllers.
11.04 Analyze and design circuits for sweep generation and synchronization in a CRT (Cathode-Ray Tube) display.
11.05 Describe the use of RAM (Random-Access Memory) and ROM (Read-Only Memory) for font generation in video display systems.
11.06 Design the serial communication interface in a video.
11.07 Modulation and interval timing techniques.
11.08 Pointing devices for computer systems.
11.09 Analyze the operation of mechanical and optical pointing devices used in computer systems.
11.10 Describe the functions of the major blocks in a dot matrix printer.
11.11 Analyze and design circuits to communicate using a standard Centronics parallel interface in a printer.
11.12 Describe the main functional blocks of a roller bed plotter.
11.13 Analyze and design subsystems including interfaces for use in a roller bed plotter.

# PROGRAM IMPLEMENTATION

It is the teacher's responsibility to ensure that students learn how to competently perform the tasks specified in the course objectives. Therefore, the teacher must lead the students through the learning experiences in a course, motivate students, act as a role model for students, and at times, function as a guidance counselor and placement coordinator. This leadership role requires the teacher to participate in many of the activities required for program implementation. The teacher must select the methods of instruction that best apply to students' ability levels, measure student achievement and provide feedback. Key factors that must be considered when implementing this program are addressed below.

## TEACHER CHARACTERISTICS

### Subject Knowledge

The teacher must be a subject matter expert who is able to implement sound instructional methods and evaluate student performance. He/she must have significant work experience in the industry/vocational field and be able to communicate that knowledge to the students.

### Instructional Delivery

The teacher's role in the learning process is to motivate and lead the student as well as impart subject matter knowledge. In order to maximize student learning, the use of a variety of instructional methods is encouraged. Because teaching styles vary greatly, teachers are highly encouraged to "pick and choose" from various methods or to combine methods for maximum benefit to students. Some of the more traditional methods used are lecture, demonstration and small group instruction. Other teaching methods which are suggested for further exploration include individualized self-paced, open-exit/open-entry, contract, computer based and competency based instruction. The focus of Competency Based Vocational Education (CBVE) is to ensure that each student can competently perform tasks specified before progressing to more complex skills.

### CONVENTIONAL INSTRUCTIONAL METHODS

A vocational program may require a portion of the instruction to be presented in a standard lecture or controlled demonstration format. These methods of instruction can be easily combined with instructor controlled step-by-step practical exercises. Some instructional activities may dictate that this instructional approach be used to introduce students to hazardous equipment often utilized in vocational training. In most situations, students should be required to perform specified activities to achieve maximum skill competency. If mastery of a task is required, competency based education methods may be more appropriate. However, if the training activity involves an orientation or a seldom performed, non-essential task, conventional instructional methods may be more effective. Teachers are encouraged to use a variety of instructional methods to best meet instructional objectives.

#### Instructional Development

Teachers often must develop and select their own teaching and curriculum materials. In developing a comprehensive curriculum, instructional objectives based upon both the performance and cognitive domain must be included. When developing curriculum materials, teachers must use the curriculum framework (CF) and student performance standards (SPS) contained in this program guide as a basis. These materials delineate minimim program content which must be presented for an approved vocational training program. However, they are not intended for use as a comprehensive curriculum. Be certain not to adapt the curriculum to available materials, but select only those materials which can be adapted to the curriculum.

#### Instructional Measurement

Teachers must select testing methods that support the instructional delivery system used. Teachers must be competent to develop, administer and evaluate written and performance type tests.

## Student Admissions Criteria

Providing the student the opportunity to successfully complete a vocational education program, in any institution, should be the primary concern of the instructional effort. Therefore, it is very important to direct planning and effort into identifying and selecting students with excellent potential for success in the educational program and in the occupation. The school's primary task is to prepare people for fulltime, entry-level positions as technicians or, in the case of those with more experience, as managers.

The Course Code Directory, specifies grade levels at which occupational programs are offered. Specific student admissions criteria which are required by the State and local educational agencies for the Computer Engineering Technology training program are illustrated as follows.

## SPECIFIC ADMISSIONS CRITERIA

| | |
|---|---|
| Minimum Age: | As required by state and local policy |
| Physical Requirements: | None |
| Special Requirements: | None |
| Minimum Basic Skills Math Level: | * 10.0 |
| Minimum Basic Skills Language Level: | * 9.0 |

* This grade level requirement is specified in the Curriculum Framework and is applicable to postsecondary level programs of 450 hours or more only. There is no minimum basic skill requirement for secondary programs.

## THE STUDENT PROFILE

Developing a student profile is an important step in program implementation. Attention should focus on student characteristics that can be remediated within a training program, but could create serious impediments to success in the vocational field. Typical of these would be deficiencies in communication and mathematical skills. The basic skill levels can be measured by testing. Test results can then be used to direct the student to more suitable training which matches his or her skill level, or to determine supplemental training which may be required to increase chances for student success.

High school and postsecondary vocational students can be admitted to a vocational program upon request if they meet any specified prerequisites, such as physical or basic skill requirements. Training programs should be accessible to as many students as possible. Training programs are designed to prepare students for employment upon graduation, or serve as prerequisite to a postsecondary program.

The community college can be more selective and establish stringent admission standards. This may be done by assessing applicants or by recruiting potential students who meet the established prerequisite requirements of the training. The program advisory committee can design a profile of the potentially successful student. The profile should contain a

list of qualities, traits and aptitudes that will indicate a higher potential for student success. Acceptable levels for these traits must also be determined. For example, the qualities deserving highest attention, mechanical ability and cognitive aptitude, are those which the educational program itself will not likely be able to influence, although these traits should have considerable weight in establishing the basic profile. Deficiencies in mathematical or communication skills may lend themselves to improvement through related instruction while the student is enrolled in the program. The following example illustrates specific qualities to consider when establishing the student profile:

**Mechanic/Technician--Service**

- Knowledge of basic tools and equipment used by mechanics/technicians
- Ability to analyze and solve mechanical and technical problems
- Ability to interpret written mechanical/technical materials
- Ability to interpret mechanical/technical drawings
- Mechanical dexterity

**Mechanic/Technical Service Management**

- Basic application of service
- Business skills
- Ability to work with people
- Communication skills
- Leadership

## QUALIFYING AND PRETESTING

Assessing potential students for vocational programs is an integral part of the recruiting process since considerable amounts of time and money will be spent on students entering training. Recruiters must have a good idea of the candidate's basic aptitude. Whoever guides the candidate to the program needs to have knowledge of the student's interests, abilities and experience. These can be measured by a variety of assessment methods, which should be performed upon program entry. The assessment can help determine extent and level of training each individual should receive.

The minimim basic skills requirement for mathematics and language skills is specified on the curriculum framework. Assessment should determine the level at which the student can read, write, calculate mathematics and understand the English language. It is appropriate for the program advisory committee and the school to develop some selection criteria based on minimum skill levels. These criteria should remain flexible in order to maximize educational opportunity for all applicants. Additionally, vocational educators must make every effort to serve the variety of "special needs" students and to eliminate sex-bias and stereotyping in all occupational areas.

## ADVISORY COMMITTEE

It is imperative that representatives of industry be organized into an advisory committee. Constantly changing technological demands of our society will continue to stimulate changing industrial patterns. Therefore, effective use of program advisory committees is vital to the successful implementation of vocational training programs. Advisory committees provide expert technical advice which is not easily obtainable elsewhere, offer external support of policies and have tremendous public relations potential.

The most effective advisory committees are those whose members have mutual respect for each other's abilities and vested interest in the training program because of their need for trained workers. The program advisory committee is also one of the most effective means of facilitating placement. Its role can be:

- To contact local industry and encourage them to use the school's placement office as a means of filling jobs
- To develop an effective procedure for interviewing and evaluating potential employees suggested by the school
- To assist in gathering accurate and current job information as it becomes available

## COUNSELING AND GUIDANCE

Counseling of students serves two purposes. It guides the student into the program and it supports enrolled students on a continuing basis throughout the program. Much day-to-day counseling will be the responsibility of the teacher. The teacher has the most contact with the student and is in a position to detect and correct a problem. Each student will encounter new problems as the program develops. The teacher's job is to work with the student to help identify problems and then strive for solutions. The teacher will provide much of the counseling that focuses on trade knowledge and skills.

The professional counselor cannot be expected to have the subject matter expertise of the primary teacher. The counselor, however, can focus on the student's needs related to other issues such as personal growth, interests and attitudes. The ideal situation will provide at least one counselor with current knowledge of industry standards for career counseling. A useful tool which should be used in the counseling process is the Career Merit Achievement Plan (Career MAP) which presents minimum instructional content keyed to student performance standards. Career MAPs are available for each industrial program area, and can be used to document student achievement, isolate student interests, talents and weaknesses. They are also useful for placement purposes. Information on Career MAPs may be obtained by contacting the Department of Education, Division of Vocational, Adult, and Community Education, (904) 488-0484.

### STUDENT PLACEMENT

Implementing an effective placement system is integral to developing a successful vocational training program. **S.B.E. Rule 229.551 (3)(g)** requires 70 percent placement of students who have completed a vocational training program. Although placement is not always a problem, as with students already working in a related occupation, the placement program should place emphasis upon students who are seeking entry-level employment since these students have little or no experience with industry.

The task of the placement program is to locate job openings in the community. The placement coordinator or teacher must know each student's personal aims and interests in addition to the information stated on the achievement record. In many cases, teachers are the best source to match students to job openings because of their contacts with the industry advisory committee. Input concerning employment openings must come from individual business establishments in the community. The placement coordinator should introduce a student to as many suitable job openings as possible. Conversely, employers can then be expected to interview as many qualified candidates as possible.

## Cooperative Education

### COOPERATIVE EDUCATION APPLICABILITY

Normally, a student will complete the entire program as a full-time student before obtaining employment as a computer electronics technician. However, there may be situations where a student could be allowed to complete part of the program while employed as a computer electronics technician. At this time it is appropriate for the student to enroll in industrial cooperative education (ICE). Guidelines for this training plan are provided in the "Industrial Cooperative Education Program Guide," published by the Division of Vocational, Adult, and Community Education, Order # IE 508 BK 87.

Industrial cooperative education is a method of instruction designed to prepare students for jobs in the community. This method is a joint effort between the school and the business community. Student trainees receive a combination of instruction in the classroom and related on-the-job training through employment. Learning experiences are jointly planned and supervised by the teacher and the employer. Cooperative education is relevant to the needs of the student preparing for a work role, and will help the student to achieve success and personal satisfaction as the transition is made from school to the constantly changing world of work.

Cooperative education is defined in the Federal Register, Volume 39, number 143, Vocational Education, Section 102.96, as a program ". . . to prepare students for employment, through: (a) providing meaningful work experiences combined with formal education enabling students to acquire knowledge, skills, and appropriate attitudes, (b) removing the artificial barriers which separate work and education, (c) involving educators with employers, creating interaction whereby the needs and problems of both are made known, thereby making it possible for occupational curricula to be revised to reflect current needs in various occupations . . . ."

## PURPOSE

Cooperative Education is for persons who, through written cooperative arrangements between the school and employers, receive instruction, including required academic courses and related instruction by alternation of study in school with a job in any industrial occupational field. These two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternative half days, full days, weeks or other periods of time to fulfill objectives of the cooperative education program.

## GOALS AND OBJECTIVES

The primary goal of the cooperative method of vocational education is to prepare skilled, responsible individuals who can assume a productive role in the community. Specific objectives to meet the primary goal are:

- To prepare individuals for employment, adjustment and advancement in specified occupations or occupational areas (primary objective)
- To provide an understanding of the contribution of work to the social and economic welfare of our nation
- To provide students with an understanding and appreciation of the American free enterprise system
- To foster an awareness of the civic, social and moral responsibilities of individuals to society

- To stimulate students' interest in their chosen occupational fields and provide an understanding of the opportunities in each field
- To provide training that results in increased efficiency in performing job tasks
- To provide curriculum which is sensitive and adaptable to changes in occupational practices and procedures as they are affected by societal, economic, technical and educational developments
- To strive to develop a greater appreciation of the value of specifically trained personnel among employers, employees and consumers
- To reinforce skills learned in the school laboratory
- To provide experiences on tools and equipment not available in the school laboratory
- To supplement and broaden the school curriculum into areas not otherwise available

## Student Organization Participation

Vocational student organizations operate pursuant to federal and state laws, which authorize them as viable components of vocational education programs. According to federal regulations, the vocational education program of instruction may include activities of vocational student organizations which are an integral part of the vocational instruction offered and which are supervised by vocational education personnel. The **S.B.E.** Rules authorize vocational student organizations as an integral part of the vocational education program as stated in **S.B.E. 6A-6.064 (7)** and **6A-6.065 (8).**

### VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)

VICA is an organization for secondary or postsecondary students enrolled in trade and industrial education programs in high schools, area vocational technical centers and junior and community colleges. It is the only national and international organization for trade and industrial students. The organization is designed to expand and enrich opportunities for leadership, social awareness and civic responsibility in vocational students.

Students who participate in VICA activities are often better prepared for the world of work. They acquire knowledge of the many opportunities available in their chosen careers and become aware of the value of their

contributions to society. They are also given opportunities to develop and utilize their talents and abilities in ways that otherwise would not be available to them.

## BENEFITS OF VICA MEMBERSHIP FOR THE STUDENT

Membership in VICA offers the student the opportunity for growth and development in the following areas:

**School and Community Service Activities** Students in VICA become involved in various school and/or community services. These may include clothing or food collections for the needy, donation of time and service to the elderly and participation in fund raisers or similar activities.

**Social Interaction with Fellow Students** Activities are also available that offer students time for relaxation and fun. Social activities of this type may be held on a regular basis. They might be held on the school campus during school hours, or off campus after school. More formal functions would include end of the year award banquets or industry/employer appreciation dinner banquets.

**Competition in Skill and Leadership Contests** VICA offers various contests in all the skill and leadership areas it serves. Often, teachers identify talented students who represent their school in regional competitions. However, any student member of VICA may compete. Instructors should conduct planned contests within their trade areas. This also pertains to leadership areas. First and second place regional winners then move on to the state level contest. The state winners then compete at the national level of the United States Skill Olympics.

# INSTRUCTIONAL RESOURCES

## STUDENT REFERENCE MATERIALS

Necessary instructional texts or pertinent material should be available for each student to satisfy training objectives. When textbooks are used, the copyright date should be as current as possible.

## SERVICE MANUALS

Manuals with current manufacturer's service procedures and specifications should be available. These manuals must be located where students can use them while working in the shop area.

## PERIODICALS

Current general and technical magazines and newspapers should be available for student and instructor use.

The following list of suggested resources is organized under each outcome shown in the curriculum framework. These resources have been recommended by instructors and program administrators through statewide surveys.

## 01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Computerfacts (for all computer areas)*<br>Robert C. Brenner | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |
| *Digital Electronics*<br>Tokheim | McGRAW HILL BOOK COMPANY | text |
| *Digital Fundamentals*<br>Floyd | MERRILL PUBLISHERS | text |
| *IBM PC Advanced Troubleshooting and Repair Guide*<br>Robert C. Brenner<br>ISBN#0-672-22590-5 | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |
| *IBM PC Troubleshooting and Repair Guide*<br>Robert C. Brenner<br>ISBN#0-672-22358-9 | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |
| *Microcomputer Hardware Operation and Troubleshooting* | McGRAW HILL BOOK COMPANY | text |
| *Microcomputer Hardware, Operator, and Troubleshooting with IBM PC Applications*<br>Byron W. Putman | PRENTICE-HALL, Division of Simon & Schuster | text |
| *Microcomputer Troubleshooting*<br>James Perozzo<br>ISBN#0-8273-2500-2 | DELMAR PUBLISHING | text |
| *Small Computer Theory and Applications*<br>Dailey | McGRAW HILL BOOK COMPANY | text |
| *The Visible Computer: 8088* | SOFTWARE MASTERS | text |
| *Troubleshooting IBM PC's and Clones* | CHILTON BOOK COMPANY | text |

## 02.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Computers and Computer Languages*<br>Silverman and Turkiew | McGRAW HILL BOOK COMPANY | text |
| *Learning Assembly Language*<br>Heath | HEATH COMPANY | text |
| *Microprocessor Architecture, Programming and Applications with the 8085/8080A*<br>Gaonkar | MERRILL PUBLISHERS | text |
| *MS-DOS Handbook* | McGRAW HILL BOOK COMPANY | text |
| *PC-DOS Tips and Traps* | McGRAW HILL BOOK COMPANY | text |
| *The 8085A Microprocessor Software, Programming and Architecture*<br>Brey | PRENTICE-HALL MEDIA | text |
| *Z-80 Assembly Language Programming*<br>Lance A. Leventhal | McGRAW HILL BOOK COMPANY | text |
| *MS-DOS*<br>John Hubbard | HEATH/ZENITH EDUCATIONAL SYSTEMS | text/audio /software |

## 03.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Local Area Network Book*<br>E. G. Brooner<br>ISBN#0-672-22254-4 | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |

## 04.0 DEMONSTRATE AN UNDERSTANDING OF PERIPHERAL EQUIPMENT

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *IBM PC Peripheral Troubleshooting and Repair*<br>Charles J. Brooks<br>ISBN#0-672-22529-8 | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |
| *Microcomputer Hardware Operation and Troubleshooting* | McGRAW HILL BOOK COMPANY | text |
| *Microprocessors and Peripherals*<br>Brey | MERRILL PUBLISHERS | text |
| *Disk Drive Alignment and Troubleshooting* | DIGIAC CORPORATION | text/audio /software |

## 05.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Microcomputer Troubleshooting*<br>Heath | HEATH COMPANY | text |

## 06.0 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|

NONE

## 07.0 DEMONSTRATE PROFICIENCY WITH HIGH-LEVEL COMPUTER PROGRAMMING LANGUAGES

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *C Programming*<br>Steve Worthington | PWS Kent | text |

ISBN 08783529X

| | | |
|---|---|---|
| *Common Sense Basic*<br>Dean & Effinger<br>ISBN 0-15-512298-3 | HARCOURT, BRACE JOVANOVICH | text |
| *Pascal*<br>James Richards<br>ISBN 0-15-0568160-5 | HARCOURT, BRACE JOVANOVICH | text |
| *Structured Programming Using Fortran 77* | HARCOURT, BRACE JOVANOVICH | text |

## 08.0 DEMONSTRATE PROFICIENCY IN COMPUTER NETWORKING TECHNIQUES

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Using Novel Netware*<br>Bill Lawrence | MACMILLAN COMPUTER PUBLISHING | text |

## 09.0 DEMONSTRATE PROFICIENCY IN THE USE OF MICROCOMPUTER DISK OPERATING SYSTEM SERVICES AND FUNCTIONS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Discovering MS-DOS*<br>Kate O'Day<br>ISBN#0-672-22407-0 | HOWARD W. SAMS AND COMPANY, Division of Macmillan, Inc. | text |

## 10.0 DEMONSTRATE PROFICIENCY IN ANALYSIS AND DESIGN OF DATA COMMUNICATIONS SYSTEMS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Data Communications* | PRENTICE-HALL, Division of Simon & Schuster | text |
| *Data Communications*<br>Schweber | McGRAW HILL BOOK COMPANY | text |

## 11.0 DEMONSTRATE PROFICIENCY IN THE ANALYSIS AND DESIGN OF PERIPHERAL EQUIPMENT USED IN COMPUTER SYSTEMS

| TITLE, AUTHOR, ORDER# | PUBLISHER | TYPE |
|---|---|---|
| *Dot-Matrix Printer and Alignment* | DIGIAC CORPORATION | text/audio /software |

**PUBLISHERS' ADDRESSES**

CHILTON BOOK COMPANY
Chilton Way
Radnor, PA 19089
215-964-4000

DELMAR PUBLISHING
2 Computer Drive West
Albany, NY 12212
518-459-1150

DIGIAC CORPORATION
19 Power Drive
Hauppage, NY 11788

HARCOURT BRACE JOVANOVICH
6277 Sea Harbor Drive
Orlando, FL 32887

HEATH COMPANY
Post Office Box 1288
Benton Harbor, MI 49022
800-253-0570

HEATH/ZENITH EDUCATIONAL SYSTEMS
Post Office Box 167
St. Joseph, MI 49085

HOWARD W. SAMS AND COMPANY
Division of MacMillan, Inc.
4300 West 62nd Street
Indianapolis, IN 46268
800-428-7267

MACMILLAN COMPUTER PUBLISHING
11711 N College Avenue, Suite 140
Carmel, Indiana 46032

MERRILL PUBLISHERS
1300 Alum Creek Drive
Columbus, OH 43216
800-848-6205

McGRAW HILL BOOK COMPANY
1221 Avenue of the Americas
New York, NY 10020
212-512-2000

PRENTICE-HALL MEDIA
90 South Bedford Road
Mt. Kisco, NY 10549
914-631-8300

PRENTICE-HALL
Division of Simon & Schuster
Route 9 West
Englewood Cliffs, NJ 07632
201-592-2000

SOFTWARE MASTERS
Post Office Box 3638
Bryan, TX 77805

# FACILITIES

## Facility Design Recommendations

Facilities, tools and equipment are essential parts of training programs, and must be designed to meet State program standard requirements and instructional objectives. This section of the Program Guide contains information for setting up classroom and laboratory facilities. Facility design criteria and space requirements are specified in **S.B.E. Section B, Chapter 6A-2.**

### TEACHING FACILITIES

The instructional environment should duplicate, as closely as possible, the real-life work environment the student will enter after graduation. The more the school resembles the industrial environment, the easier it will be for the student to make the transition from school to work. Tools, supplies and equipment should conform to local industry standards. The teacher should actively pursue supplemental resources to expose the students to state-of-the-art equipment.

All facilities should include classroom space, as well as space for regular classroom equipment such as audio-visual equipment. Laboratory facilities should be equipped with work stations or workbenches, tables, chairs and special training aids to demonstrate basic principles and theory. They should contain enough tools and equipment to enable several students to work individually on the same learning activity.

### UPDATING FACILITIES

To keep pace with technological changes and improvements, facilities must be updated on a continuing basis. When planning facilities, priority must be to provide space which will fulfill changing needs of the instructional program. Buildings should be designed with flexibility to expand in order to accomodate future program changes and to allow for greater ease of facility updating. The program advisory committee should be used to assist the school in establishing priorities for obtaining facilities, tools and equipment. Careful planning and analysis of current and future needs will lead to the establishment of an effective training environment.

## SCHOOL FACILITIES

### Computer Servicing Technology Classroom/Laboratory Areas

This section of the program guide provides guidelines for Computer Engineering Technology program facilities. All vocational programs must meet additional requirements specified in **S.B.E. Section B, Chapter 6 A-2.**

The classroom/laboratory areas should include sufficient student work stations. Each work station should be equipped with special lighting, as necessary. The work stations should provide shelving on which test equipment will be placed. The shelving should be above or adjacent to the bench work area.

The laboratory should include electrical outlets providing 110 volts at each work station. Electrical outlets should be permanently mounted to the work station benches. Additional electrical outlets should be installed along the walls and in the center areas of the laboratory. Electrical outlets in the center areas should be mounted on posts between the ceiling and work stations or on pull down extension systems. Special electrical wiring may be required to supply power requirements of specialized equipment. All electrical service must be installed according to local building code requirements.

## CLASSROOM/LABORATORY FACILITIES

Space requirements for **new** facility construction for this program are specified in **S.B.E. Rule 6A-2.032** as shown below.

**NEW FACILITIES**
COMPUTER ENGINEERING TECHNOLOGY

| | |
|---|---|
| Occupant Design Stations | 20 |
| Net Square Feet Per Occupant | |
| Minimum | 72 |
| Normal | 76 |
| Maximum | 79 |
| Total Net Square Feet | |
| Minimum | 1440 |
| Normal | 1520 |
| Maximum | 1580 |

## WORK STATION ARRANGEMENT

The arrangement of work stations and specialized equipment depends upon the general layout of the facilities, but careful consideration must be given to convenience to entrances and exits, easy movement among work stations and tool/storage areas. The area should have a counter convenient to work stations. Overall layout of the facility should be planned so that the location of entrances and exits permits a logical flow of work in progress. One of the most critical factors in planning a facility is the arrangement of work stations to obtain a safe, efficient traffic pattern.

## ADDITIONAL FACILITY CONSIDERATIONS

### Training Stations

Training stations and live work areas must be available in the type and number required to meet program goals and performance objectives.

### Instructional Area

A classroom or designated area of the laboratory should be available for lecture, instruction, viewing audio visual materials and other nonshop activities.

### Personal Tool/Equipment Storage Area

A secure storage room or area should be provided, with enough shelf space for student supplies/tool boxes and floor space for equipment.

### General Storage

Storage areas for tools, parts, supplies and machines must be sufficient to support the activities outlined in the program goals and performance objectives.

### Office Space

An area separate from the classroom and laboratory should be available and convenient for use by the instructor(s) as an office.

### Maintenance

A regular facilities maintenance program must be implemented to ensure that equipment and facilities are safe and usable to meet instructional needs.

### Housekeeping

The classroom, laboratory and support area(s) must be kept clean and orderly.

**Ventilation**

A fume/dust removal system should be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning. Ventilation requirements are stated in **S.B.E. Rule 6A-2.066.**

**First Aid**

A first aid station must be in place, well marked and complete with appropriate supplies.

**Support Facilities**

Restrooms, clean-up areas and lockers convenient to the shop should be available for students.

**Safety**

The facilities must meet all Occupational Safety and Health Administration (OSHA) safety standards, where applicable.

**Facility Evaluation**

The program advisory committee should be asked to conduct an annual evaluation of the facilities to insure the program's continuing capability to meet instructional objectives.

# Safety, Maintenance and Liability

**SAFETY**

**S.B.E. Rule 6A-2.097**

The Florida State Board of Education establishes rules for the operation of public schools. **Part III, Section B, Chapter 6A-2** of the State Board of Education Rules contains the standards for existing educational facilities. Subsections deal with the entire school facility in regard to such topics as electrical equipment, flammable materials, ventilation, fire safety, storage and illumination. Subsection 6A-2.097 contains safety regulations pertaining to vocational classes.

The statute requires 100 percent protection of every student and teacher participating in laboratory work wherein the type of activities listed in the statute above are conducted. This will include: demonstration by teachers or students, students and teachers present in a room or laboratory when students are engaged in make-up work or project work, and when anyone is using tools for construction or repair work involving the shaping or cutting of any solid materials.

Rules and regulations for an eye protection program should be organized and distributed to teachers, students and school personnel. Safety devices should be worn by those participating in the activity and by those who are observers or who may be in close proximity.

**Electrical Safety**

Safety hazards present in electrical or electronic shops include the possibility of electric shock, touching hot electrical components, or being hit by sparks or materials from exploding electrical components.

Special instructions should be provided to students concerning the following safety hazards:

1. Electric shock
   A. How to avoid electrical shock
   B. What to do for individuals who are subjected to electrical shocks

2. Burns
   A. How to identify and handle hot electrical components
   B. Treatment of minor burns

3. Exploding materials
   A. Causes of explosions and types of components likely to explode
   B. Protection from flying materials

**Marking of Hazardous Areas**

Floors, walls, posts, stationary objects, machinery and equipment should be properly painted, marked, coded or identified, according to recommended safety practices of OSHA, the school board and industry.

**Emergency Procedure For Injuries**

The following procedures are recommended in the event of an injury or sudden illness in a student:

- Refer to the red "fire or medical emergency" signs posted in appropriate areas.
- Provide immediate first aid if so qualified.
- Notify appropriate personnel to advise them of the problem. They can also contact emergency trained personnel on campus.
- A conscious person has the right to refuse treatment and/or transportation to a medical facility.
- Advise students that they will be financially responsible for ambulance and emergency care.

- The paramedics will assume patient care upon arrival.
- If emergency transportation is not indicated, the student may spend time at the clinic, be allowed to go home or go to a medical facility.
- Be sure to complete the appropriate student injury form for any and all accidents or sudden illness.

## MAINTENANCE

Schools should have the necessary facilities for routine maintenance. Special maintenance requirements for this program concern the electronic trainers and test equipment. Arrangements must be made to accomplish routine and non-routine maintenance on the trainer stations, test equipment, soldering equipment and computer systems. Maintenance arrangements can be made through the school's laboratory, the manufacturer or an outside agency.

## VOCATIONAL TEACHER LIABILITY

### Liability of Teacher and School Board

Negligence of vocational education teachers can cause unnecessary injury, and may result in teacher and school district liability. Vocational teachers are recommended to carry personal liability insurance. To reduce the risk of liability and injuries, the following suggestions are provided.

- Follow accepted policies of the school board.
- Do not allow students to use equipment or tools which have not been approved by the administration and Board of Education.
- Establish safety rules and enforce them.
- Do not leave the shop/laboratory while students are working.
- Do not permit non-enrolled students to use the shop/laboratory.
- Do not allow students to use machines or tools for which instruction has not been given.
- Do not approve unsupervised student activities inside or outside the shop/laboratory.
- Prepare accident forms for all accidents.

- Regularly inspect the workplace and equipment for defects or potential hazards and maintain documentation of unserviceable or hazardous items.
- Consider age, maturity, skill and ability of students when providing instruction and supervision.
- Adminster safety tests to students upon completion of the demonstration of a specific machine, tool or process and keep documentation on file in your office.
- Require all students to wear eye protection devices, when appropriate, for laboratory activities.

# SUGGESTED EQUIPMENT LIST

## General Classroom Equipment

**DESCRIPTION**

Chalkboard

Bulletin board

Bookcases

Cabinet-storage

Student study stations

Audio-visual equipment as needed

## Laboratory Tools and Equipment

These tools and items of equipment are normally used in this program. Equipment items are listed under each outcome, corresponding to the curriculum framework. Consumable supplies should be readily available to assure continuous instruction. Consumable supplies such as solder and wire are not contained in the equipment list.

## 01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE

### DESCRIPTION

Accessory set/vom meter/multimeter
Analog FET volt-ohm-milliameter
Antistatic mats/devices
Bus monitor card for IBM PC (Applied Physics Company Model Crowcard, or equivalent)
Computer printed circuit boards & components
Computer servicing & troubleshooting software
Curve tracer (Leader LTC-905 or equivalent)
Desktop computer microprocessor trainer system or equivalent
Fire blanket & case
Fire extinguishers (as needed)
First aid kit
Frequency counter (Tektronix CFC 250 or equivalent)
Function generator, (Tektronix CFG 250 or equivalent) 20 Vpp @ 50 ohms, must have triangular, square, & sine wave output with DC offset capabilities
Hammer, ball-peen
IC inserter/extractor, 14-40 pin
LCR bridge (Leader LCR-704 or equivalent)
Logic analyzer (Interplex or Global 1620A or equivalent)
Logic probes, digital (Beckman Circuitmate LP-10 or equivalent)
Magnifying glass, 10 power
Mainframe work station for plug-in printed circuit boards, with patch cords & power supply, (dual range +12Vdc, .2A & +5Vdc, 1 Amp), 12 volt lamps (1 watt) (Degem EB 2000 or equivalent)
Multimeter, digital (DMM) (Tektronix model CDM 250 or equivalent)
Nut driver set
Oscilloscope, dual trace, 20 MHZ, with delay line and probes (Tektronix 2225 or equivalent)
Oscilloscope, four channel, 100 MHZ (Iwatsu SS5710 or equivalent)
Parts kits, basic, AC circuits
Parts kits, DC circuit
Pliers, adjustable
Pliers, crimpers
Pliers, diagonal
Pliers, electrical
Pliers, needlenose
Pliers, round nose
Power supplies, 120V, surge protected
Ruler, steel

Safety can
Safety glasses
Scissors
Screwdriver set, flat blade
Screwdriver set, jeweler's
Screwdriver set, offset
Screwdriver set, phillips
Screwdriver set, phillips offset
Signal generator
Socket set, drive, 1/4
Socket set, extension
Socket set, metric
Solder suction device
Soldering rework and repair skill development kit (PACE 6993-0063 or equivalent)
Soldering rework and repair training stations (PACE 8001-0048 or equivalent)
Soldering stations, with soldering iron (Weller EC 3000 or equivalent)
Storage rack, 50 shelves
Tape measure
Tester, capacitor, wide voltage range
Tool boards
Tool box, large
Tool set, electronics shop
Trainer systems, microcomputer (Heath/Zenith EZ 150 or equivalent)
Trainer systems, microprocessor (Heath/Zenith ETW 3800 or equivalent)
Trainer systems, microprocessor or equivalent including: chip: microprocessor; chips: LSSI, MSI & SSI; connectors: 2, ZIF, 50-pin or equivalent, display modules; 6, 7-segment; keypad, HEX, 16-key, dual function; monitor program, 2K, in ROM; user RAM, 1K
Transformer, isolation, AC, with variac
Transistor checker (Leader LTC 906A or equivalent)
Tweezer
Vise, electronic (Pana Vise #324 or equivalent)
Volt-ohm-milliameter (VOM)
Workbench, wood, 3 ft. x 6 ft. or equivalent
Wrench set, adjustable
Wrench set, allen
Wrench set, combination/open-end
Wrench set, metric

## 02.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS

### DESCRIPTION

Desktop computer (IBM XT compatible or better) with 20 Mb hard disk, instructors computer managed laboratory (CML) system, dot matrix printer, local network cable and CML software
Desktop computer trainer (Heath/Zenith EZ 151 or equivalent)
Flow chart template

## 03.0 DEMONSTRATE AN UNDERSTANDING OF COMMUNICATION INTERFACING

### DESCRIPTION

Modem devices

## 04.0 DEMONSTRATE AN UNDERSTANDING OF PERIPHERAL EQUIPMENT

### DESCRIPTION

Breakout boxes (RS-232, RS-449, Centronics, GPIB or equivalent)
Computer floppy disk & hard disk drives
Computer printers & terminals
Interconnection cables and appropriate connectors
Trainer, floppy disk alignment, with drives

## 05.0 DEMONSTRATE AN UNDERSTANDING OF CUSTOMER SITE REQUIREMENTS AND CONSIDERATIONS

### DESCRIPTION

Anti static devices

## 06.0 DEMONSTRATE PROFICIENCY WITH HIGH-LEVEL COMPUTER PROGRAMMING LANGUAGES

DESCRIPTION

NONE

## 07.0 DEMONSTRATE PROFICIENCY IN COMPUTER NETWORKING TECHNIQUES

DESCRIPTION

Impedence meter (Sencore LC-75 or equivalent)
Local Area Network (LAN) with cables and interfacing equipment
Proto board
Substitution box, resistor/capacitor
Wire strippers/cutters

## 08.0 DEMONSTRATE PROFICIENCY IN THE USE OF MICROCOMPUTER DISK OPERATING SYSTEM SERVICES AND FUNCTIONS

DESCRIPTION

NONE

## 09.0 DEMONSTRATE PROFICIENCY IN ANALYSIS AND DESIGN OF DATA COMMUNICATION SYSTEMS

DESCRIPTION

NONE

## 10.0 DEMONSTRATE PROFICIENCY IN THE ANALYSIS AND DESIGN OF PERIPHERAL EQUIPMENT USED IN COMPUTER SYSTEMS

DESCRIPTION

NONE

# PROFESSIONAL DEVELOPMENT

## Teacher Technical Updating

Technical updating workshops are scheduled periodically throughout the State, usually in the summer months. Teachers should take advantage of the opportunity to attend the computer electronics technical update workshops when they are held. All instructional staff are encouraged to participate in as many training opportunities as possible.

Teachers should seek opportunities with local companies to maintain currency with industry trends. During periods when school is not in session, teachers are encouraged to make arrangements to return to industry for suitable involvement in their area of expertise.

Membership in professional associations offers vocational educators an enormous range of opportunities for working together to strengthen the field and to develop personal competence and satisfaction in work. The associations have similar goals and activities. They seek excellence in program content by means of joint efforts among members, communications that keep members current, forums for the discussion of issues in the field, useful and stimulating publications and sound professional growth experiences at local, state, regional and national meetings and annual conventions. They are concerned with increasing public understanding and support of the field. Teachers are encouraged to maintain affiliation with professional organizations. A list of professional organizations follows this section of the guide.

## Teacher Standards

As a prerequisite to certification, teachers must have the required years of experience in the appropriate technical field as defined in the certification standards. For the Computer Engineering Technology program, the requirements are six years continuous experience in computer electronics. The teacher is then judged qualified to teach upon meeting one of the following criteria: (1) regular or temporary Florida teacher's certificate with appropriate coverage, (2) Approval of local school board consistent with adopted school policy or (3) regular or temporary Florida teacher's certificate with other than appropriate coverage (has met all occupational experience requirements prescribed as a prerequisite to appropriate certification and has been approved by the school board to teach

out-of-field.) Refer to the Curriculum Framework for this program to determine the appropriate occupational specialization coverage required for certification.

Instructional staff must have technical competency and meet all State and local requirements for certification. Instructors should hold current, nationally recognized certification in the subject areas taught, if awarded. Beginning teachers must be enrolled in the State Beginning Teacher Program.

A systematic method of obtaining "substitute" instructors, approved by the school board, should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent instructor in the occupational area and specific competencies taught.

## Professional Organizations and Support Services

### EDUCATION ORGANIZATIONS

AMERICAN VOCATIONAL ASSOCIATION (AVA)
1410 King Street
Alexandria, VA 22314
800-826-9972

FLORIDA ASSOCIATION FOR TRADE AND INDUSTRIAL EDUCATION, INC. (FATIE)
Florida Department of Education
Industrial Education - Vocational Division
Knott Building
Tallahassee, FL 32399
904-488-0484

FLORIDA VOCATIONAL ASSOCIATION (FVA)
1420 North Paul Russell Road
Tallahassee, FL 32399
904-878-6860

FLORIDA VOCATIONAL INDUSTRIAL CLUBS OF AMERICA (VICA)
Florida Department of Education
Knott Building
Tallahassee, FL 32399
904-488-0484

### TRADE ORGANIZATIONS

This list contains trade associations and technical societies. Many offer training programs of some sort, either directly or through their member companies. Specific details should be requested in writing.

ARMED FORCES COMMUNICATIONS AND ELECTRONICS ASSOCIATION (AFCEA)
4400 Fair Lakes Court
Fairfax, VA 22033-3899
703-631-6178

NATIONAL ASSOCIATION OF RADIO AND TELECOMMUNICATIONS ENGINEERS (NARTE)
Post Office Box 15029
Salem, OR 97309
503-581-3336

ELECTRONIC INDUSTRIES ASSOCIATION
2001 Eye Street, Northwest
Washington, DC 20006
202-457-4900

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) 345 East 47th Street
New York, NY 10017
212-705-7900

COMPUTER AND COMMUNICATIONS INDUSTRY ASSOCIATION
666 11th Street, Northwest
Washington, DC 20001
202-783-0070

COMPUTER AND BUSINESS EQUIPMENT MANUFACTURING ASSOCIATION (CBEMA)
311 First Street, Northwest, 5th Floor
Washington, DC 20001
202-737-8888

COMPUTER AIDED MANUFACTURING INTERNATIONAL (CAM-I)
611 Ryan Plaza Drive, Suite 1107
Arlington, TX 76011
817-860-1654

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
2101 L Street, Northwest, Suite 300
Washington, DC 20037
202-457-8400

AMERICAN ELECTRONIC ASSOCIATION (AEA)
2680 Hanover Street
Palo Alto, CA 94304
408-720-0117

ELECTRONICS TECHNICIANS ASSOCIATION, INTERNATIONAL (ETA-I)
604 North Jackson
Greencastle, IN 46135
317-653-8262

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)
7380 North Lincoln Avenue
Lincolnwood, IL 60646
312-677-2850

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State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE588 BK-91

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# CAREER MERIT ACHIEVEMENT PLAN (CAREER MAP)

## COMPUTER ENGINEERING TECHNOLOGY

**(0615.040200)**

STUDENT'S NAME

**State of Florida**

*An affirmative action/equal opportunity employer*

**DEPARTMENT OF EDUCATION**
Betty Castor, Commissioner of Education

**DIVISION OF VOCATIONAL, ADULT AND COMMUNITY EDUCATION**
Robert S. Howell, Director

**DEVELOPED BY:**
University of South Florida
Department of Adult and Vocational Education

**INDUSTRY-BASED PARTNERSHIP PROGRAMS:** The State of Florida is committed to the development of industry-based partnership programs, designed by education and industry to respond to industry's demand for a highly skilled work force.

## ACKNOWLEDGEMENTS

### PARTNERSHIP WITH INDUSTRY

The following industry representatives are recognized, in addition to original industry members, for their valuable contributions to the identification and validation of the Computer Engineering Technology competencies reflected in this MAP:

Ronnie J. Barber, Manatee River Labs
Michael K. Bearden, Tampa Electric Company
Cecil W. Bingham, Martin-Marietta Aerospace
Randy Dautrich, Aidlin Automation Corporation
Ben Douglas, Lockheed Space Operations Company
Lawrence R. Eslinger, Eaton Corporation
Frederic E. Finch, C.O.W. Industries
Wanda Ford, United Telephone
Michael T. James, Zytek
Roy K. Paxton, Loral Data Systems
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William Scout, AT & T
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## THIS MERIT ACHIEVEMENT PLAN RECORDS THE COMPUTER ENGINEERING TECHNOLOGY ACHIEVEMENTS OF:

**Student's Name** _____

**Student ID Number** _____

**Student's Address** _____

_____

**Initial Instructor** _____

**School** _____

**Date Started** _____

## PRIMARY JOB TITLE(S) FOR COMPUTER ENGINEERING TECHNOLOGY

- Computer Engineering Technicians

Program completers qualify for the primary job title(s) listed above. Related job titles may be added based on those job titles found in industry and/or the Dictionary of Occupational Titles.

## OVERVIEW

This Career MAP includes the competencies required for entry into the field of computer engineering. Business and industry representatives have recommended that students in this field master these competencies in order to become employable. Local education agencies (LEAs) may adapt these competencies to meet their workforce needs.

## PURPOSE OF THE MAP

The purposes of the MAP are: to display the student performance standards (SPS) required by the LEA and to document the level of achievement on student performance standards that the student demonstrates.

## HOW TO USE THE MAP

*Administrator and Instructor*. The administrator and instructor can use Career MAPs in curriculum planning, program updating and improvement and teacher recruitment, selection and updating. If the LEA changes or adds student performance standards, the revised or additional student performance standards should be included in the blank boxes that appear within each intended outcome or at the end of this MAP.

*Instructor*. The instructor can use Career MAPs to keep track of student progress on student performance standards. By periodically reviewing the ratings on student performance standards, the instructor can identify a student's strengths and weaknesses and, on that basis, identify the skills for which the student needs remedial instruction or advanced training. The MAP can also be useful in student counseling and evaluation.

*Co-op Instructor/Employer*. The employer who sponsors a co-op program should use the Career MAP for keeping a record of the student's performance on appropriate standards. The MAPs will also help the co-op instructor/employer in counseling and evaluating the student.

*Student*. The student may use the MAP to show potential employers the performance standards he or she has mastered. In order to present a complete record, the student should encourage the instructor/co-op employer to rate his or her level of achievement on all the appropriate student performance standards and to fill in the verification form/cooperative work experience page in the back of this MAP.

*Employer*. The MAP shows an employer the student performance standards mastered by the student (a prospective employee) and the proficiency level achieved on each student performance standard. This information can help the employer make decisions about hiring, job assignments and job-training needs.

## RATING STUDENT PERFORMANCE STANDARDS

*Performance Competencies.* Ratings on student performance standards should be based upon business/industrial performance standards. The evaluator observes and evaluates student performance as he or she would in the role of the employer or supervisor.

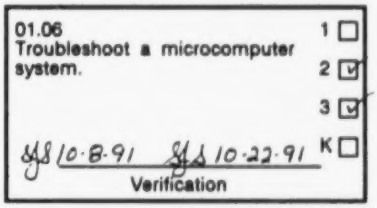
For each skill listed the learner receives a rating of 1, 2 or 3. Each rating indicates a particular level of achievement:

**1** = Learner demonstrates knowledge and understanding of this student performance standard, but is not yet able to apply that knowledge or understanding.

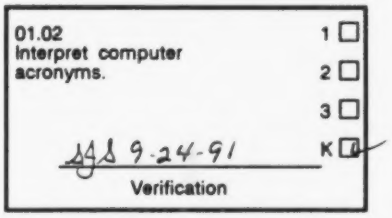
**2** = Learner performs this student performance standard satisfactorily with only periodic supervision.

**3** = Learner performs this student performance standard satisfactorily without supervision.

Whenever a performance standard is demonstrated, the instructor checks the appropriate rating box (1, 2 or 3) and initials and dates the verification line. If the student later demonstrates a higher level of achievement on a performance competency, the instructor checks the higher level and then enters his or her initials and the new date on the verification line, as shown in the following example:




*Knowledge Competencies.* For each SPS that is a knowledge competency only, with no manipulative skill involved, only one level of achievement is possible. If the student masters the competency, he or she receives a check in the bottom box ("K"), as shown below:




NOTE: A student performance standard without a checked rating indicates that the learner has not mastered the standard from lack of either ability, time, opportunity or need (the student's area of specialization may not have required it).

## 01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEMS ARCHITECTURE.

| | | |
|---|---|---|
| 01.01 Draw & explain systems configurations in block detail. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 01.02 Interpret computer acronyms. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 01.03 Identify & define priorities & interrupts at system level. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 01.04 Define & list direct memory access handling systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 01.05 Define functions of advanced memory techniques (e.g. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 01.06 Troubleshoot a microcomputer system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 02.0 DEMONSTRATE PROFICIENCY IN SOFTWARE FUNDAMENTALS.

| | | |
|---|---|---|
| 02.01 Load & run operating system software. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.02 Load & run diagnostic software & utilities. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.03 Construct flow charts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 02.04 Analyze flow charts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.05 Identify & define computer languages & their uses. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.06 Write a simple computer program in BASIC. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 02.07 Read a PROM. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.08 Erase & program an EPROM. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 02.09 Analyze firmware concepts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

| | | |
|---|---|---|
| 02.10 Troubleshoot firmware using defined hardware. 1 2 3 K Verification | 02.11 Analyze firmware writing concepts. 1 2 3 K Verification | 1 2 3 K Verification |
| 1 2 3 K Verification | 1 2 3 K Verification | 1 2 3 K Verification |

## 03.0 DEMONSTRATE PROFICIENCY IN COMMUNICATION INTERFACING.

| | | |
|---|---|---|
| 03.01 Identify & define serial & parallel interface standards. 1 2 3 K Verification | 03.02 Identify, define & configure sync & async devices. 1 2 3 K Verification | 03.03 Demonstrate the use of interface devices. 1 2 3 K Verification |
| 03.04 Identify & define networking levels. 1 2 3 K Verification | 03.05 Identify & define protocols. 1 2 3 K Verification | 03.06 Troubleshoot & repair network systems. 1 2 3 K Verification |
| 03.07 Identify & define multiuser systems. 1 2 3 K Verification | 1 2 3 K Verification | 1 2 3 K Verification |
| 1 2 3 K Verification | 1 2 3 K Verification | 1 2 3 K Verification |
| 1 2 3 K Verification | 1 2 3 K Verification | 1 2 3 K Verification |

## 04.0 DEMONSTRATE PROFICIENCY IN PERIPHERAL EQUIPMENT.

| | | |
|---|---|---|
| 04.01 Install, analyze & troubleshoot interface controllers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 04.02 Install, analyze & troubleshoot display terminals. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 04.03 Install, analyze & troubleshoot printer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 04.04 Install, analyze & troubleshoot magnetic tape equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 04.05 Install, analyze & troubleshoot disk drive equipment. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 04.06 Define environmental requirements for peripherals & media. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 05.0 DEMONSTRATE PROFICIENCY IN CUSTOMER SITE REQUIREMENTS & CONSIDERATIONS.

| | | |
|---|---|---|
| 05.01 Apply effective customer relations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 05.02 Follow installation procedures. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 05.03 Calculate & determine power requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 05.04 Calculate & determine environmental requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 05.05 List & perform preventative maintenance techniques & requirements. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 06.0 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS.

| | | |
|---|---|---|
| 06.01 Describe effective listening techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 06.02 Describe techniques for instilling customer confidence. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 06.03 Describe techniques for keeping the customer informed. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 06.04 Demonstrate proper follow-up techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 07.0 DEMONSTRATE PROFICIENCY WITH HIGH-LEVEL COMPUTER PROGRAMMING LANGUAGES.

| | | |
|---|---|---|
| 07.01 Write a technical program in a high-level programming language (e.g. Fortran, Cobol, Basic, C) & associated system level concepts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 07.02 Identify & define associated system level concepts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 07.03 Apply structured programming such as loop structures, sorting techniques, data structures & arithmetic operations. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 08.0 DEMONSTRATE PROFICIENCY IN COMPUTER NETWORKING TECHNIQUES.

| | | |
|---|---|---|
| 08.01 Identify & define computer networking techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 08.02 Design a system using hardware & software communication protocols. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 08.03 Apply management techniques for network software. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 09.0 DEMONSTRATE PROFICIENCY IN THE USE OF MICROCOMPUTER DISK OPERATING SYSTEM SERVICES AND FUNCTIONS.

| | | |
|---|---|---|
| 09.01 Describe the historical development of computer operating systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.02 Describe the major hardware & related software subsystems of microcomputer DOS (Disk Operating System) 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.03 Describe various disk formats. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 09.04 Program using assembly language to access the ROM-BIOS feature for peripheral control & serial communications. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.05 Describe the extended services of enhanced systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.06 Describe design decisions involved in implementing Input/Output (I/O) interfacing using interrupts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 09.07 Program using assembly language to implement I/O device interfacing using interrupts. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.08 Program using the extended DOS functions. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 09.09 Analyze & design software systems using ROM-BIOS, DOS functions & interrupts for use in a multiplexed analog to digital system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 09.10 Analyze & design software systems using ROM-BIOS functions & interrupts for use in a synchronous digital data system. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

| | | |
|---|---|---|
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |

## 10.0 DEMONSTRATE PROFICIENCY IN ANALYSIS AND DESIGN OF DATA COMMUNICATIONS SYSTEMS.

| | | |
|---|---|---|
| 10.01<br>Describe the different types of digital data communications systems.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.02<br>Describe data formats & transmission rates in serial data communications systems.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.03<br>Design the connections & programming for a UART in a microprocessor-based system.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 10.04<br>Identify & define available options for integration of a display terminal in a data communication system.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.05<br>Identify & define communication signals & protocol for MODEM (Modulator Demodulator) links.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.06<br>Apply digital modulation techniques including PAM, PCM, PWM & delta modulation.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 10.07<br>Analyze & design circuits for generation & detection of digital modulation.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.08<br>Apply error detection & correction in digital communication systems.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 10.09<br>Define communication protocols.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 10.10<br>Design & apply multiplexing techniques for computer.<br>1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |

COMPUTER ENGINEERING TECHNOLOGY

## 11.0 DEMONSTRATE PROFICIENCY IN THE ANALYSIS AND DESIGN OF PERIPHERAL EQUIPMENT USED IN COMPUTER SYSTEMS.

| | | |
|---|---|---|
| 11.01 Design & analyze circuits used in various functions of video display systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.02 Analyze various types of disk drives & disk drive controllers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.03 Analyze various types of printers & plotters & their related interface controllers. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 11.04 Analyze & design circuits for sweep generation & synchronization in a CRT (Cathode-Ray Tube) display. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.05 Describe the use of RAM (Random-Access Memory) & ROM (Read-Only Memory) for font generation in video display systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.06 Design the serial communication interface in a video. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 11.07 Modulation & interval timing techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.08 Pointing devices for computer systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.09 Analyze the operation of mechanical & optical pointing devices used in computer systems. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 11.10 Describe the functions of the major blocks in a dot matrix printer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.11 Analyze & design circuits to communicate using a standard Centronics parallel interface in a printer. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 11.12 Describe the main functional blocks of a roller bed plotter. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 11.13 Analyze & design subsystems including interfaces for use in a roller bed plotter. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 0.0 DEMONSTRATE EMPLOYABILITY SKILLS.

| | | |
|---|---|---|
| 0.01 Conduct a job search. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.02 Secure information about a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.03 Identify documents that may be required when applying for a job. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 0.04 Complete a job application form correctly. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.05 Demonstrate competence in job interview techniques. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 0.07 Identify acceptable work habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.08 Demonstrate knowledge of how to make job changes appropriately. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 0.09 Demonstrate acceptable employee health habits. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

## 00.0 DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP.

| | | |
|---|---|---|
| 00.01 Define entrepreneurship. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 00.02 Describe the importance of entrepreneurship to the American economy. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 00.03 List the advantages & disadvantages of business ownership. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 00.04 Identify the risks involved in ownership of a business. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 00.05 Identify the necessary personal characteristics of a successful entrepreneur. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 00.06 Identify the business skills needed to operate a small business efficiently & effectively. 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |
| 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification | 1 ☐ 2 ☐ 3 ☐ K ☐ Verification |

P.O.W.E.R. SKILLS (PRINCIPLES OF WORK ENVIRONMENT READINESS)

## 000.0 COOPERATIVE WORK EXPERIENCE COMPETENCIES.

| | | |
|---|---|---|
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |
| 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification | 1 ☐<br>2 ☐<br>3 ☐<br>K ☐<br>Verification |

## VERIFICATION

The instructor should verify the level of mastery achieved by the student by initialing the competency box each time the student masters a competency. Later, if the student achieves a higher degree of mastery of a competency, the higher degree should be recorded and verified by the instructor.

INSTRUCTOR SHOULD SIGN FULL NAME AND SCHOOL NAME AND ADDRESS IN THE SPACE BELOW.

| | |
|---|---|
| _____ Verification | _____ Signature<br>_____ Title<br>_____ School Name<br>_____ School Address<br>_____ |
| _____ Verification | _____ Signature<br>_____ Title<br>_____ School Name<br>_____ School Address<br>_____ |
| _____ Verification | _____ Signature<br>_____ Title<br>_____ School Name<br>_____ School Address<br>_____ |

## COOPERATIVE WORK EXPERIENCE

In addition to classroom training and laboratory performance identified on the Career MAP, this student has participated in cooperative work experience with employers as shown below:

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

Dates _____ Employer _____

Address of Employer _____

Supervisor _____

Supervisor Title _____

## NOTES

This section of the MAP is provided so the instructor, employer, or student may list additional qualifying statements or other pertinent information. All comments should be initialed for verification.

State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
Affirmative action/equal opportunity employer

IE587 BK-91